The TENNESSEE CONSERVATIONIST

# The Mysterious American Hart's-Tongue Fern in Tennessee

**By David Lincicome**

**Photo by Al Schotz**

Nearly everyone enjoys a good mystery or adventure. There's something about the unknown that draws us in, cautiously but persistently, to seek the truth. An adventure typically leads to excitement and surprise. Put them together and oh, how the heart can race!

Well, in Tennessee botanical exploration can be just that mix, a little mystery and a bit of adventure. The American Hart's-Tongue Fern (Asplenium scolopendrium var. americanum) has sometimes been referred to as "Tennessee's rarest plant." It is indeed one of the state's rarest vascular plants. When something is rare it is usually an adventure trying to find it and sometimes a bit of a mystery too. The story behind this rare Tennessee fern is a mix of both mystery and adventure.

Carl Linnaeus first described the hart's-tongue fern in 1753. The fern gets its name from the long tongue-shaped fronds with a heart-shaped base. Since then the species has been split into possibly several varieties. The European variety is considered the traditional variety. In 1953, M.L. Fernald described the North American variety. An interesting twist to the story of this species is that a specimen collected by Jean J. Linden in 1543 (probably a transcription error as the date was more likely 1843) in Chiapas, Mexico, is now considered to be the American variety. Furthermore, there is still some debate on whether a Japanese variety is separate from the American variety. It is quite realistic that this American variety is scattered across the northern hemisphere in isolated regions!

Frederick Pursch first discovered the American Hart's-Tongue Fern on July 20, 1807, near Syracuse, New York. The fern was discovered later in Ontario, Canada, in 1857 by William Hincks; in Michigan in 1953 by Marion T. Hall and Dale Hagenah; and in Alabama in 1978 by a caver named E. Batchelder from the Huntsville Grotto and John W. Short.

Dr. Augustin Gattinger discovered the American Hart's-Tongue Fern in Tennessee in 1849. Gattinger was one of Tennessee's greatest botanists and had published the only flora for the state in 1887 and 1901. He discovered a few plants of the fern at the entrance to a cave in Roane County, west of the town of Post Oak Springs. C.L. Pollard and Dr. William R. Maxon visited the site in 1900 but found no plants. A.C. Gill visited the location in 1929, but again no plants were observed. Gill believes that picnickers may have extirpated (destroyed) the ferns. This may have occurred by over-collection or trampling.

Gill also visited a cave in Grassy Cove near Crossville where R.L. Dyal reported the plant in 1928. However, the fern was not seen and Gill believes forest fires may have extirpated the plants in 1927 and 1928.

Either Cheatham or his brother, referred to as Major Cheatham, discovered the fern near South Pittsburg in 1879. Cheatham had sent the plants, his "deer-tongues," to John Williamson in Louisville for identification since Williamson had recently published the book Ferns of Kentucky. He determined the fern to be hart's-tongue.

Since then, the site has been visited by a great variety of botanists including: Dr. Elisha L. Lee (who referred to the fern as "Bean fern" because it grew on the Bean's family land where relatives of the first Tennessee settler, William Bean, lived); R.H. Middleton; General E. Kirby Smith; William R. Maxon; A.J. Sharp; E.W. Graves; Eleanor McGilliard; A. Murray Evans; and countless others through the years.

The site remains the only known extant (surviving) population for the fern in Tennessee and for this reason has attracted much attention. But there is something more exciting about the site than just its rarity.

In Tennessee the American Hart's-Tongue Fern occurs deep within limestone sinks, surrounded by forest and graced by mountain streams and waterfalls. The South Pittsburg location is perched halfway up the slope of the Cumberland Plateau within a rugged cove. The sinkhole is approximately 30 feet wide by 75 feet long and 75 feet deep. A waterfall cascades down one corner of the sink and the water disappears into a crack at the opposite corner only to emerge again well down in the valley bottom. The vegetation surrounding the sink is green and lush, bathed by the mist from the waterfall. The remaining ferns are shaded by the steep sides of the sink and cooled by the shade and mist from the waterfall. And to make the site more treacherous, Stinging Nettle guards the access down into the sink.

What a formidable place for a rare fern to grow! It's no wonder botanists have been inspired to travel across the country to trek up a steep mountainside in search of a hidden sink harboring a small population of one of our country's rarest ferns.

The American Hart's-Tongue Fern requires cool summer temperatures, shade, moderately high relative humidity levels, and calcareous (limestone) rocky soils. Here in the Southeast (and in Mexico) these conditions appear limited to limestone sinks. In New York, Michigan, and Canada the plants are limited to limestone outcrops of the Niagara escarpment.

Mr. and Mrs. Joseph Lodge of South Pittsburg (the home of Lodge Manufacturing, makers of cast-iron cookware) became interested in the plant and estimated there to be 200 plants in the sink in 1898. Since this time, the number of plants has dramatically declined.

In 1900 there were 110 plants. There were 58 plants in 1911, and 26 plants in 1929. It is believed that sometime between 1911 and 1929 that the south slope of the sink had collapsed and destroyed a portion of the population. McGilliard reported that Graves had then introduced spores from plants in Owen Sound, Ontario, on the slope of the north side of the sink around 1929.

Only six plants were observed in 1930, two plants in 1934, but up to 26 plants in 1935. The increase in the mid-1930s was believed to be from the spores sowed by Graves. One large plant observed near the top of the sink around this time may have been transplanted at the site not long after 1929 and has been suspected to be of the European variety. So the remaining natural composition of this population is today a mystery. It is likely that early specimen collection pressure from these botanists was also a contributing factor in the population's decline.

By the late 1970s the population had stabilized to around 17 plants. In 1991, George Ramseur, from the University of the South, reported that only one or two small plants remained. In the late 1990s only two or three plants were typically observed. But in 2004, Ramseur observed five small plants.

Today the plants are still quite stunted and do not produce spores. Typical fronds for the species are five to 17 inches in length, but recently the Tennessee plants have grown fronds no longer than five inches long. The last documented report of any spore production was in the early 1980s, but possibly some were produced in 1994 when the last large plant with long leaves was reported.

The American Hart's-Tongue Fern was listed under the U.S. Endangered Species Act as Threatened

on July 14, 1989. It is listed as Endangered in Tennessee under the Rare Plant Protection and Conservation Act. The recovery criteria for the species requires 15 self-sustaining populations in the United States (two each in Alabama and Tennessee, four in Michigan and seven in New York) that are protected in order for the species to be taken off the U.S. Threatened Species list. Obviously it will be a great challenge to recover the species here in Tennessee.

Stephan Garton of Alabama A & M University started propagation and transplantation research in the mid-1990s. Spores were collected from the Alabama sites during 1993 and 1994. During this time there were only three plants at the Jackson County site and at least 33 plants at the Morgan County site. Spores from the Jackson County site showed low vigor, but spores from the Morgan County site germinated vigorously. In 1995, the first plants with fronds were produced from germinated spores collected at the Morgan County site. But, in 1998, a broken irrigation hose flooded the plants in the greenhouse and all were destroyed. It was hoped that these plants could be used to establish new populations in Tennessee and Alabama.

To help improve the laboratory growing conditions, environmental data loggers were placed in all three sinks with the hope that information on the average air and soil temperature, relative humidity, and sunlight levels and duration would aid in growing plants in culture. However, in 1998, the project was terminated due to contracting difficulties and a change in personnel. Consequently, no plants have been successfully grown and transplanted into natural habitat in the south.

In 2004, the Tennessee Division of Natural Heritage contracted with the Center for Research of Endangered Wildlife at the Cincinnati Zoo and Botanical Garden to again research the possibility of spore banking (long-term cold storage of spores using liquid nitrogen) and tissue culture propagation. Spores and leaf-tip tissue were collected from the Morgan County site with the help of Jim Hall from the Huntsville Grotto. The tissue culture propagation using the leaf-tip tissue has not been successful, but the spores have again shown vigorous germination. Currently they have several immature plants. If all goes well, they will mature into adult plants that may then serve as the source of leaf-tip tissue for the tissue culture tests. During this project no plants were observed at the Jackson County site, and because so few plants are at the Tennessee site, and their origin is suspect, no tissue was collected. Much work remains ahead to produce mature plants in culture that could be transplanted into natural habitat to establish new populations and achieve recovery goals.

There has been some success in propagating and transplanting plants from the northern populations in New York. The stock produced from these populations appears to be more robust than from the southern populations. So, propagating the southern stock and establishing new populations will remain a hopeful challenge for the future.

An important distinction between the American and European varieties is the chromosome number. The American variety has a chromosome count of 144 while the European variety has a count of 72. Consequently, the Tennessee plants could be checked in this way to determine if they are indeed the American variety. That's one mystery that could be solved. However, only through genetic testing could we determine if the plants are of Tennessee stock or from Canadian stock. That's a second mystery that could be solved. Both of these mysteries need to be solved before the Tennessee population could be augmented with propagated plants.

The American Hart's-Tongue Fern has had a long and convoluted history. Many aspects about the plant still remain a mystery, but with some persistent effort some of these mysteries can be solved. Nonetheless, working with this plant will remain an adventure. There is no way to avoid the chasms within which the plant calls home here in the Southeast. For botanists the mixture of mystery and adventure is just another day in the office. Let the adventure continue!

**(David Lincicome is the Rare Species Protection Program administrator for the Department of Environment and Conservation's Division of Natural Heritage in Nashville. Assistance with writing and visiting the Tennessee population was provided by Mary Priestley and George Ramseur of the University of the South and by Jim Hall of the Huntsville Grotto who provided assistance in visiting and collecting leaves from the Alabama populations in 2004.)**